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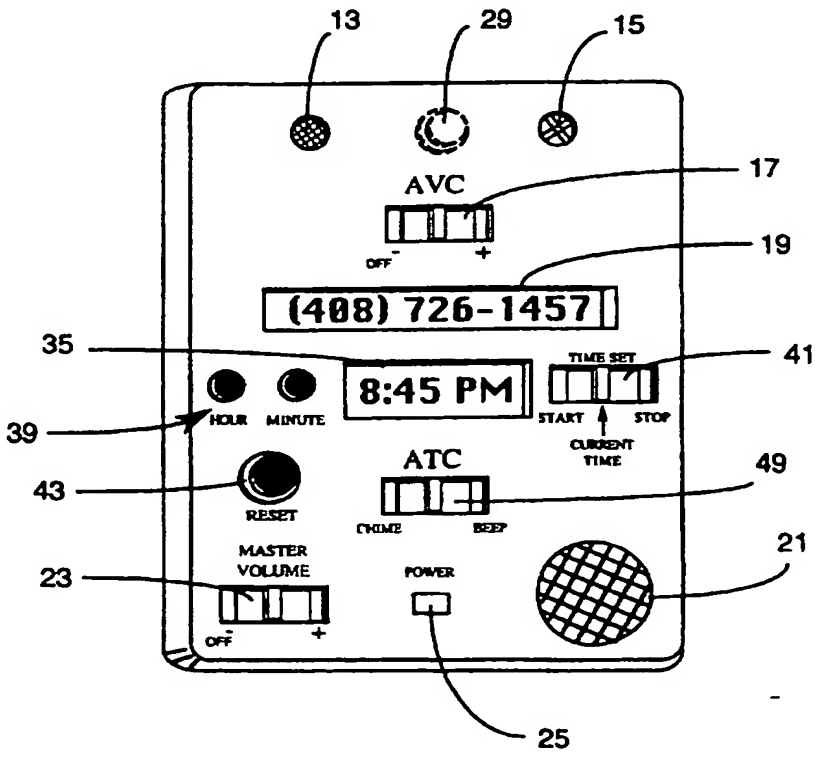
(57) Abstract

A personal electronic device, such as a pager or a cell phone, includes an ambient condition sensor (13, 15, 29), and characteristics of an alert signal provided to inform a user of receipt of a message are altered according to sensed ambient conditions. Volume of an audio signal may be raised in the event of a higher sensed level of background noise, or pitch may be increased. In the case of light emitting alerts, the light output may be flashed, or intensity or color may be altered. In one embodiment a real-time clock (35) is incorporated, and alert characteristics are altered depending upon the time of day that a message is received. Some embodiments allow a user to program threshold conditions and direction of alteration of signal characteristics.



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Selective Notification Method for Portable Electronic Devices

By Inventor
Dan Kikinis

Field of the Invention

The present invention is in the field of portable electronic devices (PEDs) with a communication interface, and relates in particular to the nature of PED alert mechanisms.

Background of the Invention

Portable electronic devices (PEDs) have evolved from simple call pagers to their current status as useful tools in a variety of configurations to suit numerous purposes, and are used by individuals or groups in a variety of disciplines. A PED is typically a radio frequency receiver with an alert mechanism, such as a beeper, chime, light, or a vibration pad, which receives signals from an alert dispatch station to notify a user that he or she should take some kind of action. Such action may be to make a telephone call, pick up a customers order, respond to an emergency, reset the PED and ignore the message, or perform any of several possible tasks. PEDs also include complex devices that use extensive interfaces between the user and a dispatch or relay station, such as a cellular telephone, a personal digital assistant, and 2-way alert systems where a user can make a single response or select one or many responses from a multiple-choice menu. These complex PEDs also typically have some kind of alert mechanism such as a beeper, chime, light, or a vibration pad, to attract a users attention.

When a PED is immediately at hand, as in a shirt or pants pocket or on a belt, it is relatively easy for a user to hear an alert mechanism's beep or feel its vibration at nominal levels. When a PED is placed on a nearby open surface, such as a table or desk top, a user can usually easily detect an alert signal from a PED's alert device, such as a flashing light, a beep or even a vibration.

At times, the user may place the PED in a pocket of an outer

garment, such as a jacket or coat, or store it for carrying in a personal carry-all, such as an attache case, backpack, or handbag. At other times a PED user may frequent a noisy factory where the lighting might be dim and the air temperature warm. During other times a user may be engaged in some kind of physical activity, such as riding a horse, jogging, or the like. Such conditions may overwhelm or muffle the nominal intensity of an alert signal so that the signal is not easily detected by a user. Current PED architectures often attempt to solve this problem by providing an apparatus to manually adjust the magnitude of its alert signal, such as a beeper's loudness, a light's brightness, and a vibrator pad's vibration intensity. In such cases, a user must be constantly cognizant of his or her environment, and make a manual adjustment to the PED's alert mechanism intensity whenever he or she determines it might be necessary.

What is clearly needed is an integrated and automatic method of adjusting the degree and nature of an PED alert mechanism according to ambient conditions, such as proximity to a user and the environment in which it is being used.

Summary of the Invention

In a preferred embodiment of the present invention a personal electronic device (PED) is provided, comprising control circuitry for managing operations of the PED; a receiver coupled to the control circuitry for receiving information from a remote source; an alert apparatus operable by the control circuitry for providing a signal to alert a user that information has been received; and an environment sensor coupled to the control circuitry for sensing a change in an ambient condition. The environment sensor communicates a change in an ambient condition to the control circuitry, and the control circuitry changes a characteristic of the alert apparatus in response.

The alert apparatus may be such as a speaker, and the control circuitry may change the volume level or frequency of an audio signal provided by the speaker in response to a change in an ambient condition provided by the environment sensor. In another embodiment the alert apparatus may be a vibrator, and the control circuitry changes the

amplitude of vibration or the frequency provided by the vibrator in response to a change in an ambient condition provided by the environment sensor. The alert apparatus may also be a light-emitting device, and the control circuitry may change intensity of light output or flashing frequency of the light in response to a change in an ambient condition provided by the environment sensor.

A number of different environment sensors may be used, either singly or in combination with others, to sense ambient conditions. Among these sensors may be a light intensity sensor, a temperature sensor, a motion detector, and a real-time clock.

Sensing environmental conditions and altering one or more characteristics of an alert signal provides extended versatility and functionality for personal electronic devices such as pagers and cellular phones.

Brief Description of the Drawings

Fig. 1 is an isometric view of a PED according to a preferred embodiment of the present invention.

Fig. 2 is a simplified block diagram of a microprocessor-based control circuit according to a preferred embodiment of the present invention.

Fig. 3 is an isometric view of a PED according to an alternative embodiment of the present invention, which includes an automatic pitch control.

Fig. 4 is an isometric view of a PED according to another alternative embodiment of the present invention, which includes a motion sensor.

Fig. 5 is an isometric view of a PED according to still another alternative embodiment of the present invention, which includes a clock.

Description of the Preferred Embodiments

In various embodiments, the present invention comprises an integrated selective notification feature providing for automatically adjusting the degree and nature of a personal electronic device's (PED)

alert mechanism according to it's proximity to a user and the environment in which it is being used.

Fig. 1 is an isometric view of a pager-type PED 11 which includes common PED elements plus the elements of a selective notification feature according to a preferred embodiment of the present invention.

PED 11 includes a master volume control 23, which also serves as a power on-off switch for the PED, a power-on indicator light 25, a small speaker 21 from which an alert signal may be broadcast, a liquid crystal display (LCD) 19 which provides a message, such as a telephone number, and a reset button 43 which acknowledges the messages and resets the PED's electronic circuitry to receive another message.

In the embodiment of Fig. 1, PED 11 has a light sensor 13 and a temperature sensor 15 to detect changes in light and temperature, respectively, within an environment where the PED is being used. Light sensor 13 and temperature sensor 15 are connected to a microprocessor control circuit, not shown in Fig. 1, but described in more detail below. The microprocessor control circuit includes control routines for adjusting loudness of an audio alert mechanism, such as an audio oscillator, amplifier and a speaker, in response to changes in light and temperature levels detected by light sensor 13 and temperature sensor 15. In one embodiment threshold values may be adjusted by the user.

PED 11 attached to a user's belt in a reasonably well-lighted office at a comfortable temperature will have its alert device loudness adjusted, using master volume control 23, to suit the user's preference. When this PED is placed in an environment with different light or temperature levels, or both, such as in an outer garment pocket, a purse, briefcase, or the like, light sensor 13 and temperature sensor 15 will detect this change and signal the microprocessor control circuit of the change. The microprocessor's control circuit will then send signals, according to user-programmed thresholds and ranges, to a volume control circuit, not shown in Fig. 1, which will automatically adjust the loudness of the alert mechanism. The alert mechanism will thus automatically be adjusted to increase the probability that it will be recognized by the user. Constant user cognizance of the PED's environment and subsequent manual adjustment will not be necessary.

As another example, if PED 11 is normally carried in an outer garment pocket, a purse, briefcase, or the like, the alert mechanism's loudness will be adjusted, using master volume control 23, to suit the user's preference for this usual situation. Then when PED 11 is placed in an environment where light or temperature levels change, such as attached to a user's belt in a reasonably well-lighted office with a normal ambient temperature, light sensor 13 or temperature sensor 15, or both, will detect this change and signal the microprocessor control circuit of the change. The PED's microprocessor's control circuit will then send signals, according to user-programmed thresholds and ranges, to the volume control circuit to adjust the loudness of the alert mechanism to increase the probability that it will be recognized by a user without being a distraction to others in the user's proximity.

In the embodiment of Fig. 1, an automatic volume control (AVC) 17 is provided so a user can program the PED's microprocessor control circuit as to how much, and in which direction, louder or softer, it should adjust the alert mechanism's loudness when sensors 13 or 15, or both, detect changes in temperature or light. AVC 17 also has an "OFF" position to disable the selective notification feature of a PED.

Fig. 2 is a simplified block diagram of a microprocessor control circuit 45 according to a preferred embodiment of the present invention. In this example, light sensor 13 or temperature sensor 15, or both, send analog signals to an analog-to-digital converter 33, which sends digitized light and temperature data to microprocessor 37. Microprocessor 37 uses pre-programmed control routines to compare digitized sensor signals with digitized user-programmed values from AVC 17, then sends adjustment signals to volume control circuit 39 to adjust alert mechanism 47's volume, louder or softer, accordingly. It will be apparent to those with skill in the art that there are broad variety of circuitry schemes which may be used to accomplish the purposes of the circuitry broadly shown in Fig. 2.

The arts of PED architecture and micro-electronic environmental sensors and control circuits are well-developed, and there are many types of sensors and circuits that can be used, and there are many ways they can be configured on a PED to satisfy the spirit and scope of the present invention. For example, the description above shows AVC 17

for user control of programmed values which determine the thresholds and ranges at which microprocessor control circuit 45 operates to adjust alert mechanism 47's loudness. AVC 17 also provides a method for a user to disable a PED's selective notification feature. Other embodiments may not have AVC 17 and use only factory pre-programmed values to determine the thresholds and ranges at which microprocessor control circuit 45 operates. Such embodiments may provide a separate switch, or the like, to disable a selective notification feature, or not have an option to disable a selective notification feature.

In some embodiments of the present invention a microprocessor-based circuit to control a selective notification feature may not be used, and instead use one or more of the many non-microprocessor types of circuitry, well-known in the art, such as a simple analog feed-back loop, and the like, may be used to alter the response of a notification depending on changing ambient conditions.

Other embodiments of the present invention may use other sensor devices than the light and temperature sensors shown in Fig. 1. For example, a PED selective notification sensor may also be a real-time clock, a motion sensor, a noise sensor, or any of many other sorts of sensor devices, or combination of sensor devices, that will provide information about a PED's environment that may affect a PED user's ability to recognize an alert signal.

Still other embodiments of the present invention may use an alert mechanisms 47 other than an audio alert mechanism as described above. For example, a PED alert mechanism 47 could also be a light, a vibrator pad, a thermoconductor, or any of many other alert mechanism, or any combination of alert mechanisms, that can evoke attention from a user and whose intensity or frequency may be varied.

Fig. 3 is an isometric view of a PED according to an alternative embodiment of the present invention, which includes an automatic pitch control mechanism. In this embodiment of the present invention, an automatic pitch control (APC) 49 is provided so a user can change the pitch of an alert signal for users who frequent environments where a higher or lower pitch is helpful for recognition of the alert signal. Light sensor 13 and temperature sensor 15 in this embodiment are connected to microprocessor control circuit 45 (see Fig. 2). Control routines that

adjust the loudness of alert mechanism 47 in this embodiment are also configured to adjust the pitch (frequency) of alert mechanism 47. The amount of pitch change is determined by user-programmed settings in microprocessor control circuit 45 through APC 49.

As an example of operation with pitch control, a PED attached to a user's belt in a reasonably well-lighted office at a comfortable temperature will have its alert mechanism loudness adjusted using master volume control 23, and AVC 17 and APC 49 adjusted to suit the user's preference for variations in loudness and pitch. When this PED is placed where light or temperature levels change, such as when a user moves from his quiet, well-lighted, environmentally-controlled office, to a poorly lighted, warm, and noisy factory environment, the PED's microprocessor's control circuit will adjust the loudness and the pitch of the alert device according to the values provided through AVC 17 and APC 49. For example, if the factory noise tends to be at a low pitch, a user may adjust APC 49 so an alert signal which occurs while a PED is in the factory environment described above, will be higher pitched to increase the probability that he or she will hear the alert signal. Conversely, a user may adjust APC 49 so an alert signal will be lower pitched if a frequented factory's noise tends to be at a high pitch.

The art of automatic pitch control circuitry is well-developed and there are many types of circuits that can be used and many ways they can be configured on a PED to satisfy the spirit and intent of this embodiment of the present invention. For example, the description above provides APC 49 to enable or disable the selective notification (off/on) and to give user control of programmed values so microprocessor control circuit 45 can determine pitch levels for an audio alert mechanism. Other embodiments may not have APC 49 and use only factory pre-programmed values to determine the thresholds and ranges at which microprocessor control circuit 45 operates to adjust alert mechanism 47 pitch. Such embodiments may provide a separate switch, or the like, to disable the portion of a selective notification feature, or not have a method to disable a selective notification feature.

This embodiment of the present invention also may use other types of alert mechanisms than pitch-changing type as shown above. For example, a PED alert mechanism responding to a dispatched

message could also be a light, where its color or pulsing frequency may be changed, a vibrator pad whose frequency changes, a beep that changes to a chime or a siren, or any alert mechanism or combinations of alert mechanisms that can evoke attention from a PED user and whose frequency and type can be varied.

Fig. 4 is an isometric view of a PED according to another alternative embodiment of the present invention, which includes a motion sensor.

In this embodiment of the present invention, a motion sensor 29 is coupled to microprocessor control circuit 45. Control routines that adjust the intensity, pitch, or type of alert mechanism 47, according to signals from light sensor 13 and temperature sensor 15, are also configured to adjust the intensity of alert mechanism 47 according to signals from motion sensor 29. In this embodiment, AVC 17 and APC 49 provide sensitivity values for a PED's selective notification feature relative to movement. A change in motion which may interfere with a user's recognition will be signaled to microprocessor control circuit 45, which will cause, in a manner already described for other sensors, a change in the loudness, pitch or type of an alert mechanism.

As an example of use of this embodiment, a PED is attached to a user's belt who spends a great deal of time sitting at a desk in an office. In such condition a PED will typically have its alert mechanism's loudness adjusted, using master volume control 23, and its AVC 17 and APC 49 adjusted to suit the user's preference. When the PED's level of motion changes, such as when a user goes jogging, rides a bicycle or a horse, or runs up or down stairs, the PED's microprocessor control circuit will adjust the loudness, pitch, or type of the alert mechanism according to user values provided through AVC 17 and APC 49.

The art of motion sensors is well-developed and there are many types of circuits that can be used and many ways they can be configured on a PED to satisfy the spirit and intent of this embodiment of the present invention. For example, almost any type of motion detector can be used. A selective notification feature may not have AVC 17 or APC 49, or both. It may use only factory pre-programmed values to adjust alert mechanism's 47 loudness, pitch, or type in response to detected motion variations. Also, in alternative embodiments, there may or may

not be an option to disable a selective notification feature.

Fig. 5 is an isometric view of a PED according to still another embodiment of the present invention, which includes a real-time clock.

Clock 35, with appropriate controls, is provided for a user to set the time period during which an alert mechanism is controlled by selective notification features in a PED. With time set switch 41 set at "Start" position, hour and minute buttons 39 can be alternatively pushed to set the time when the selective notification feature will be activated. With time set switch 41 set at "stop" position, hour and minute buttons 39 can be alternatively pushed to set the time when an selective notification feature will be deactivated. With time set switch 41 set at "current" position, hour and minute buttons 39 can be alternatively pushed to set the current time.

A PED according to this embodiment of the present invention may have clock 35 set so that the selective notification feature is deactivated during a time period when a louder, brighter, or otherwise more intense, alert signal is not desirable, such as during nighttime hours when a user is normally asleep in a quiet, dark room.

It will be apparent to those with skill in the art that there will be many alterations, other than the examples already described, that might be made in other embodiments of the invention without departing from the spirit and scope of the present invention.

What is claimed is:

1. A personal electronic device (PED) comprising:

control circuitry for managing operations of the PED;

a receiver coupled to the control circuitry for receiving information from a remote source;

an alert apparatus operable by the control circuitry for providing a signal to alert a user that information has been received; and

an environment sensor coupled to the control circuitry for sensing a change in an ambient condition;

wherein the environment sensor communicates a change in an ambient condition to the control circuitry, and the control circuitry changes a characteristic of the alert apparatus in response.

2. A PED as in claim 1 wherein the alert apparatus is a speaker, and the control circuitry changes the volume level of an audio signal provided by the speaker in response to a change in an ambient condition provided by the environment sensor.

3. A PED as in claim 1 wherein the alert apparatus is a speaker, and the control circuitry changes the frequency of an audio signal provided by the speaker in response to a change in an ambient condition provided by the environment sensor.

4. A PED as in claim 1 wherein the alert apparatus is a vibrator, and the control circuitry changes the amplitude of vibration provided by the vibrator in response to a change in an ambient condition provided by the environment sensor.

5. A PED as in claim 1 wherein the alert apparatus is a vibrator, and the control circuitry changes the frequency of vibration provided by the vibrator in response to a change in an ambient condition provided by the environment sensor.

6. A PED as in claim 1 wherein the alert apparatus is a light-emitting device, and the control circuitry changes intensity of light output

provided by the light-emitting device in response to a change in an ambient condition provided by the environment sensor.

7. A PED as in claim 1 wherein the alert apparatus is a light-emitting device, and the control circuitry flashes the light output provided by the light-emitting device in response to a change in an ambient condition provided by the environment sensor.

8. A PED as in claim 1 wherein the environment sensor is a light intensity sensor.

9. A PED as in claim 1 wherein the environment sensor is a temperature sensor.

10. A PED as in claim 1 wherein the environment sensor is a motion detector.

11. A PED as in claim 1 wherein the environment sensor is a real-time clock.

12. A method for alerting a user of information received by a personal electronic device (PED), comprising steps of:

(a) sensing receipt of information by the PED;

(b) sensing an environmental condition by an environment sensor incorporated in the PED;

(c) providing an alert signal by an alert apparatus, wherein a characteristic of the alert signal is determined by nature of the environmental condition.

13. The method of claim 12 wherein the alert signal is an audio signal, and the characteristic changed is volume level of the audio signal.

14. The method of claim 12 wherein the alert signal is an audio signal, and the characteristic changed is frequency of the audio signal.

15. The method of claim 12 wherein the alert signal is a vibration

signal, and the characteristic changed is amplitude of the vibration signal.

16. The method of claim 12 wherein the alert signal is a vibration signal, and the characteristic changed is frequency of the vibration signal.

17. The method of claim 12 wherein the alert signal is a light signal, and the characteristic changed is intensity of the light signal.

18. The method of claim 12 wherein the alert signal is a light signal, and the characteristic changed is the on-off period of the light signal.

19. The method of claim 12 wherein the environmental condition sensed is ambient light intensity.

20. The method of claim 12 wherein the environmental condition sensed is ambient temperature.

21. The method of claim 12 wherein the environmental condition sensed is motion.

22. The method of claim 12 wherein the environmental condition sensed is time of day.

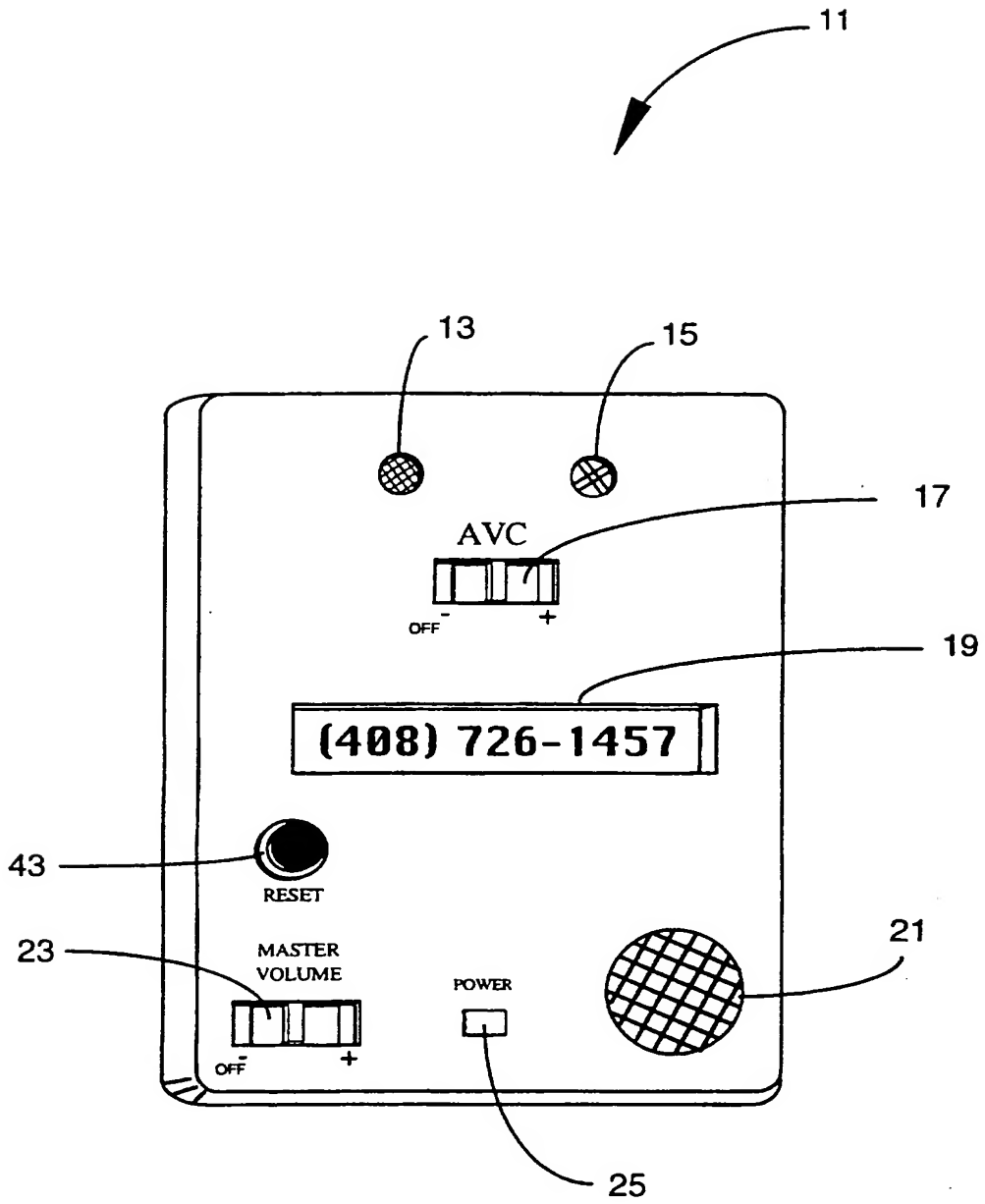
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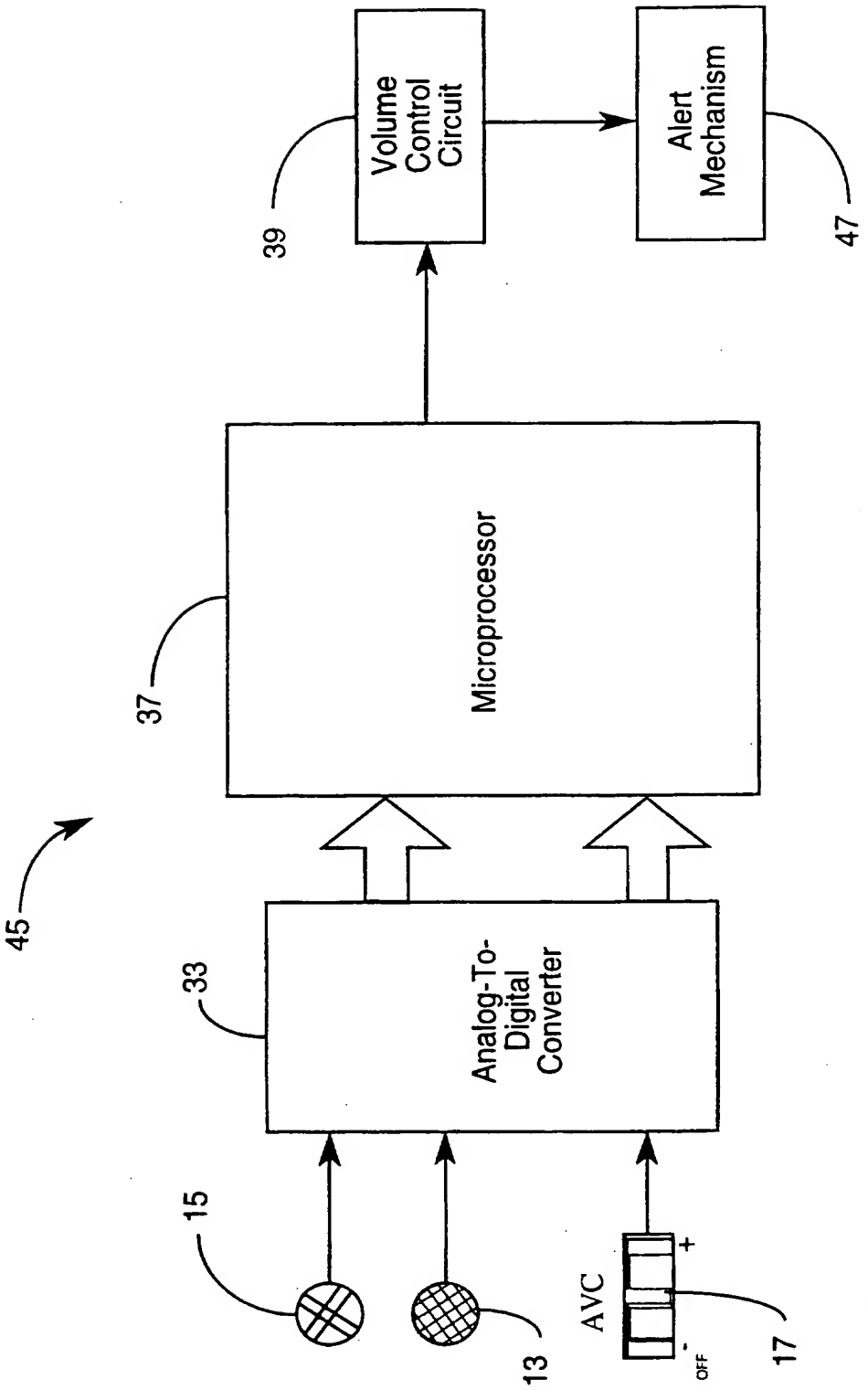
Fig. 1


Volume Control Circuit
Alert Mechanism
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47
Microprocessor
37
45
Analog-To-Digital Converter
33
15
13
AVC
+
-
OFF
17

Fig. 2

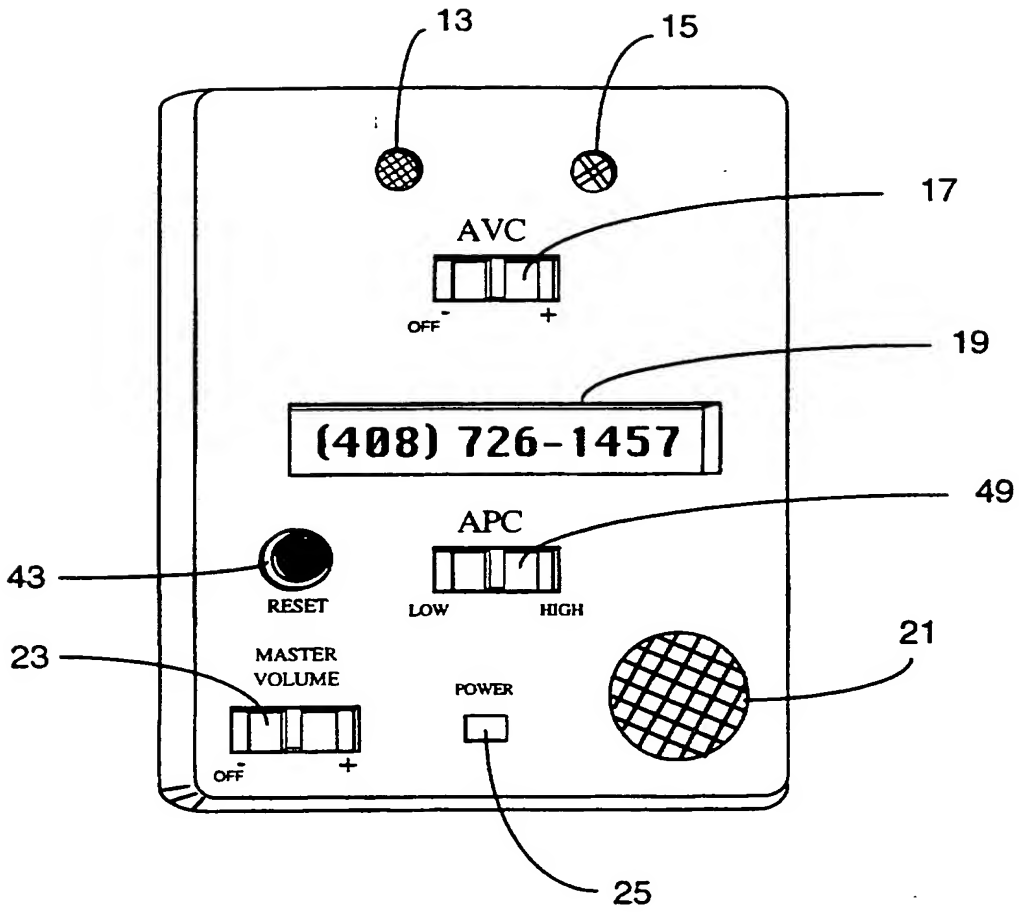
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Fig. 3

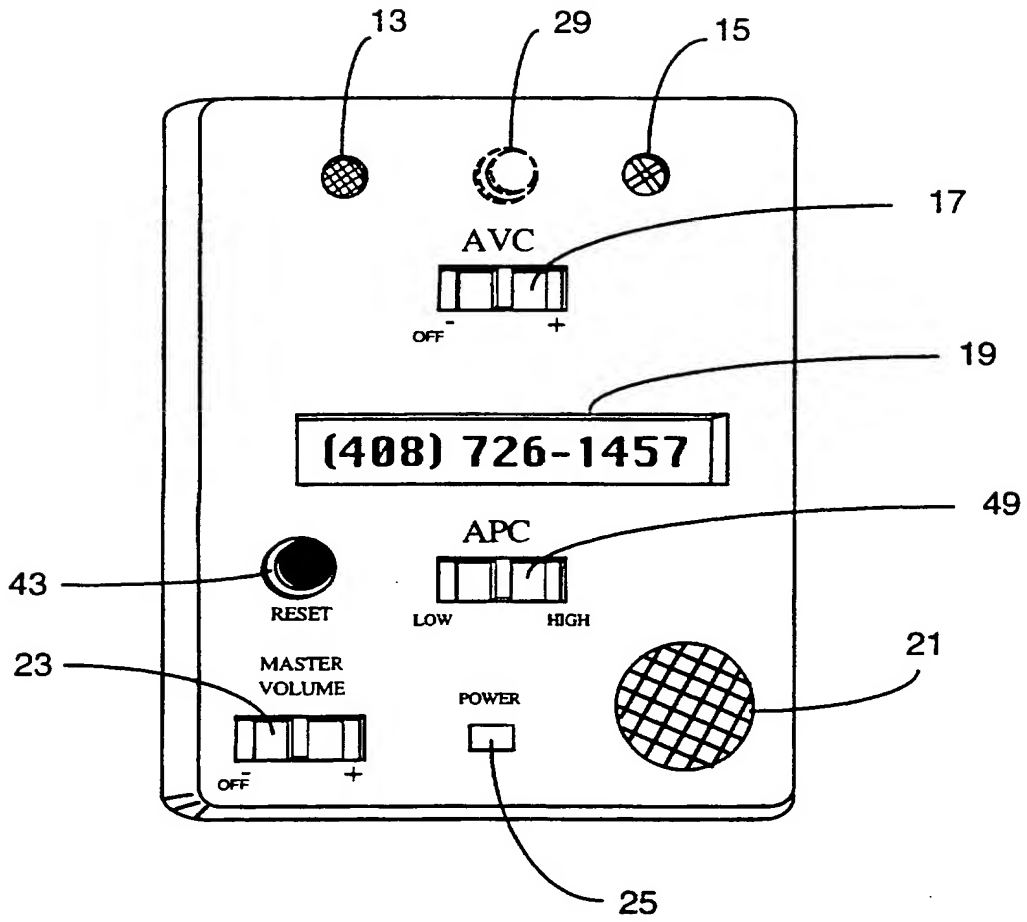
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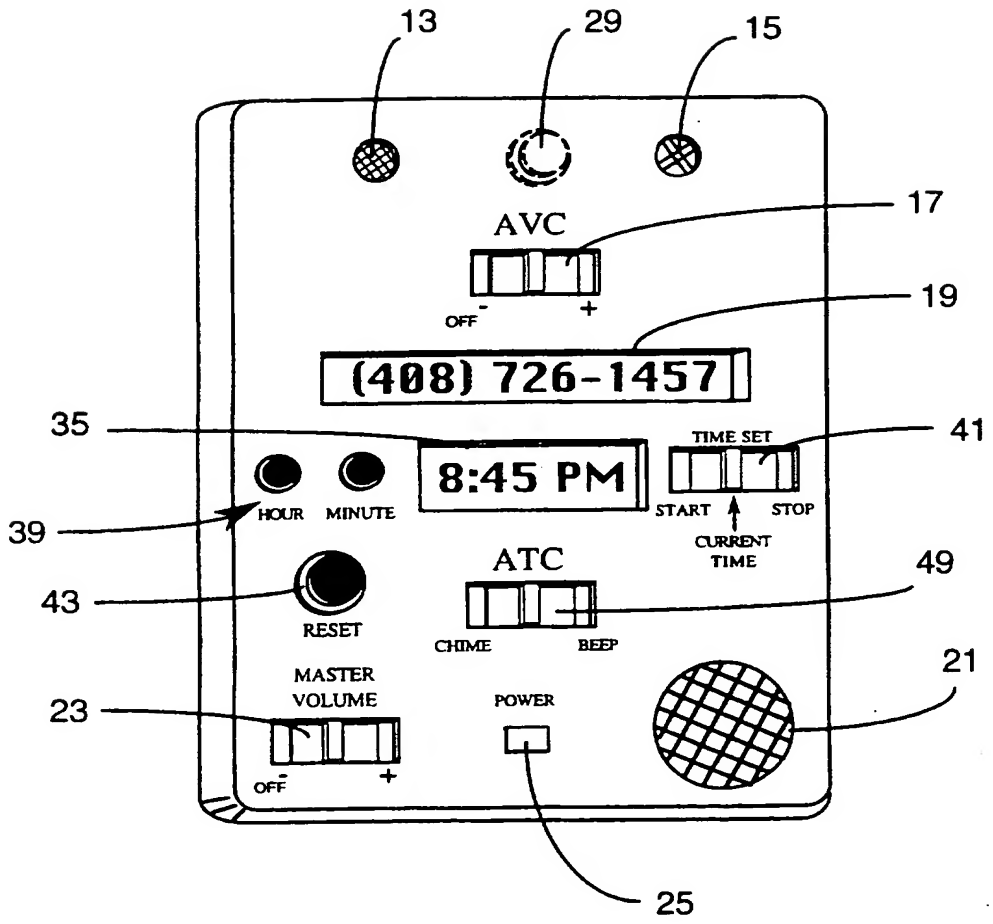
Fig.4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MINUTE
39
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STOP
CURRENT TIME
ATC
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43
RESET
CHIME
BEEP
21
MASTER VOLUME
POWER
23
OFF
25

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/17400

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04Q 7/18
US CL : 340/825.44, 825.46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS MESSENGER
Search Terms: pager, paging, selective call, sensor, detect, time, watch, electronic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P ----- Y, P	US 5,493,280 A (SHIBAYAMA) 20 February 1996, Fig. 1, col. 2, line 29 - col. 3, line 8.	1, 12 ----- 2-11, 13-22
Y	US 5,297,118 A (SAKUMOTO) 22 March 1994, Fig. 1 and col. 4, lines 19-49.	2-11, 13-22
Y, P	US 5,481,506 A (KITA) 02 January 1996, Figs. 1-2 and col. 2, line 61 - col. 3, line 17.	2-11, 13-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 13 JANUARY 1997	Date of mailing of the international search report 07 APR 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer MICHAEL HORABIK Telephone No. (703) 305-4704

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/17400

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

340/825.44, 825.46, 825.47, 825.52, 825.69, 311.1, 691, 584;
455/38.2, 57.1, 344;
368/10, 11